

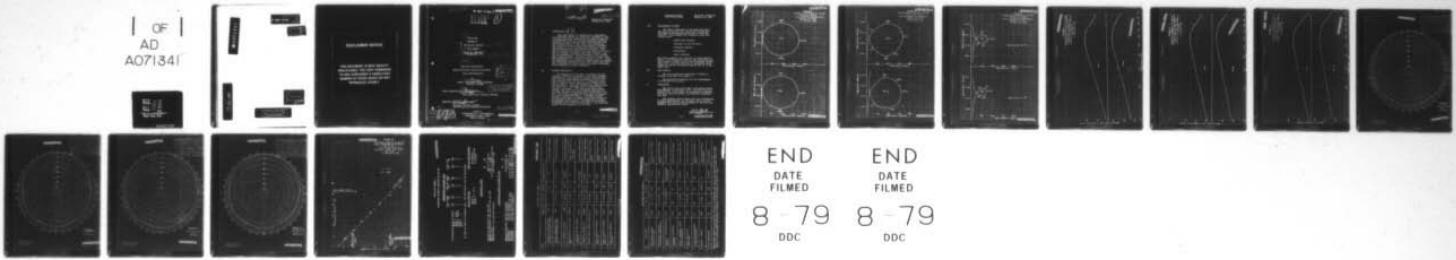
AD-A071 341 HAZELTINE CORP BRAINTREE MASS ELECTRO-ACOUSTIC SYSTE--ETC F/G 17/1
HAZELTINE (AN/BQS-6) TRANSDUCER ELEMENT. SUPPLEMENT.(U)
FEB 64 R A PLANTE

UNCLASSIFIED

EASL-AS-9

NL

| OF |
AD
A071341



END
DATE
FILED
8-79
DDC

END
DATE
FILED
8-79
DDC

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DDC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

UNCLASSIFIED

EE MOST Project-4 CONFIDENTIAL

LEVEL #1

⑥ Hazeltine
(AN/BQS-6)

Transducer Element, Supplement

⑦ Test Report

Report No. EASL-AS-9
⑪ 25 February 25, 1964

⑭ EASL-AS-9

⑫ 29P. Hazeltine Corporation

Electro-Acoustic Systems Laboratory

Avon, Massachusetts

D D C
RECORDED

JUL 19 1979

A

⑩ By R. A. Plante

Senior Transducer Design Engineer
Acoustic Systems

DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

Tests Performed By:

J. E. WADE

Test Supervisor, Acoustic Systems

Approved: B. W. Renner

G. W. RENNER

Manager, Acoustic Systems
Electro-Acoustic Systems Laboratory

UNCLASSIFIED

This material contains information affecting
the National Defense of the United States,
within the meaning of Espionage Laws, Title
18, U.S.C., Sections 793 and 794, the trans-
mission or revelation of which in any manner
to an unauthorized person is prohibited by
law.

GROUP 4
DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10

CONFIDENTIAL

400565

Accession For	
NTIS Classification	
DDC TAB	
Unclassified	
Justification	
<i>Letter on file</i>	
Printed Name	File No.
Address	
City State Zip	
Dist	Serial

~~CONFIDENTIAL~~

UNCLASSIFIED

Report No. EASL-AS-9
February 25, 1964

I.

INTRODUCTION *A 23* *CD*

This Test Report is submitted as a supplement to a Hazeltine Report No. EASL-AS-6, December 5, 1963. A company sponsored program was initiated at EASL to make available four (4) Hazeltine developed AN/BQS-6 elements for Navy prototype qualification tests per MIL-S-22974(SHIPS), 31 May 1962. The program was also directed toward gaining information on element uniformity to aid in establishing material procurement tolerances and new assembly techniques. This Report presents the results of tests made on the first two (2) elements completed under this program. Two (2) more elements now being assembled will be tested and a report issued. The major portion of these tests were conducted at an ambient temperature of 4°C. Since low temperature is the greatest single cause for transducer efficiency degradation, the test results presented here represent the near minimum operational efficiency of the Hazeltine AN/BQS-6 elements.

II.

ELEMENT DESCRIPTION

The elements are the same as pictured and described in Report No. EASL-AS-6. The active element consists of a lead zirconate ceramic cylinder which will meet the requirements of Paragraph 3.8.18.2.3 MIL-S-22974(SHIPS), 31 May 1962. A titanium front mass is used to ensure uniform piston motion with a minimum weight. The front housing and titanium mass are joined by a watertight bond of acoustically isolating elastomer. The rear steel mass, active ceramic, and front mass are cemented together with an epoxy adhesive and mechanically biased with a tie rod. The ceramic element and rear mass are treated to improve heat dissipation. A pressure release system is utilized to separate the active portion of the transducer from the front housing and the main cylindrical steel housing. The rear of the housing is secured with a steel plate bonded to the cable and sealed to the housing by an "O" ring.

~~CONFIDENTIAL~~

UNCLASSIFIED

CONFIDENTIAL

Report No. EASL-AS-9
February 25, 1964

III. MEASUREMENTS PROGRAM

The water temperature at the EASL Open Water Test Site during the test period was 4°C and all the acoustic measurements were made at this temperature. Each element was subjected to the following tests:

Hydrostatic Pressure

Impedance in Air and Water

Frequency Response

Directivity

Power Linearity

The pulse technique was used for all water measurements. All measurements except power linearity were made without a tuning coil in the transducer circuit. Tests were conducted according to procedures established in the ASA Publication Z24.24-1957 of 31 December 1957.

IV. TEST RESULTS

The test results are presented in Figures I through XI and Test Data Sheet I.

The calibration accuracy for all measurements is estimated to be ±1 db.

V. CONCLUSIONS

The test results show that an efficiency better than 50% can be obtained at 4°C. The data also indicates that a high degree of uniformity is possible when good quality control, and assembly techniques are used.

The elements tested comply with the requirements of MIL-S-22974(SHIPS), 31 May 1962, and it is recommended that they be made available to the Navy for AN/BQS-6 qualification tests.

R. A. Plante
R. A. Plante

CONFIDENTIAL

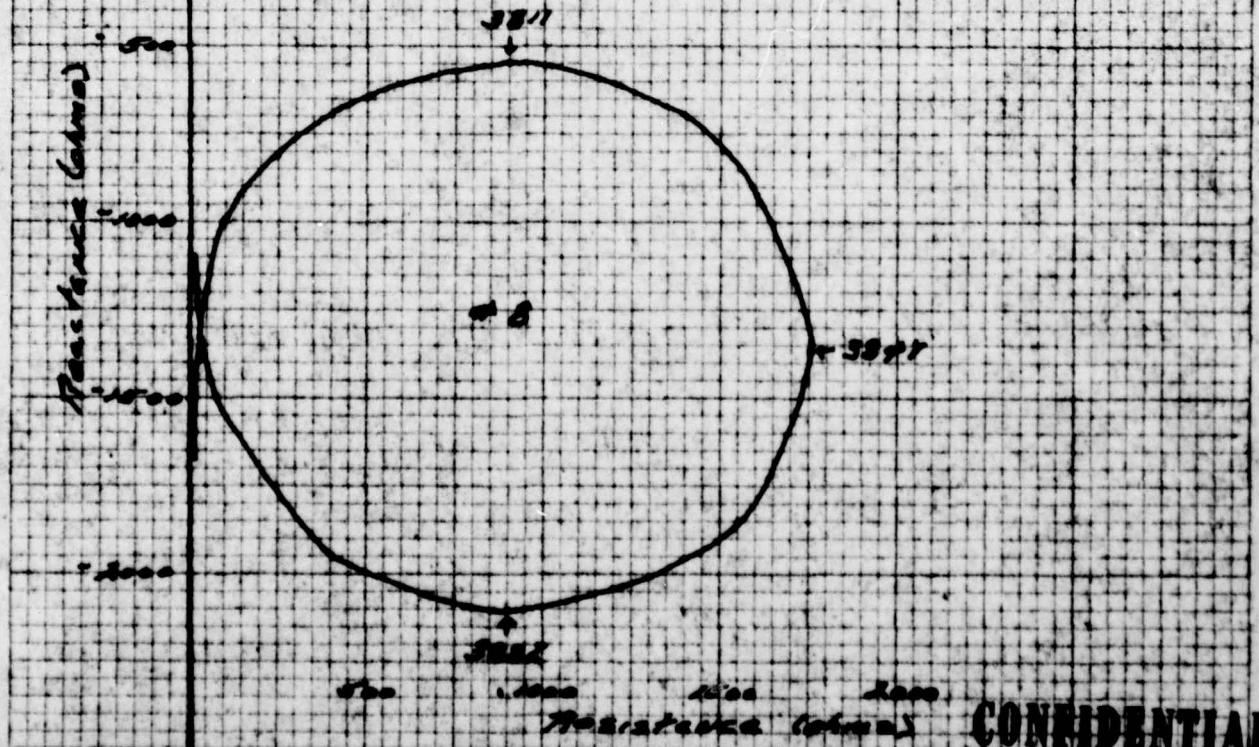
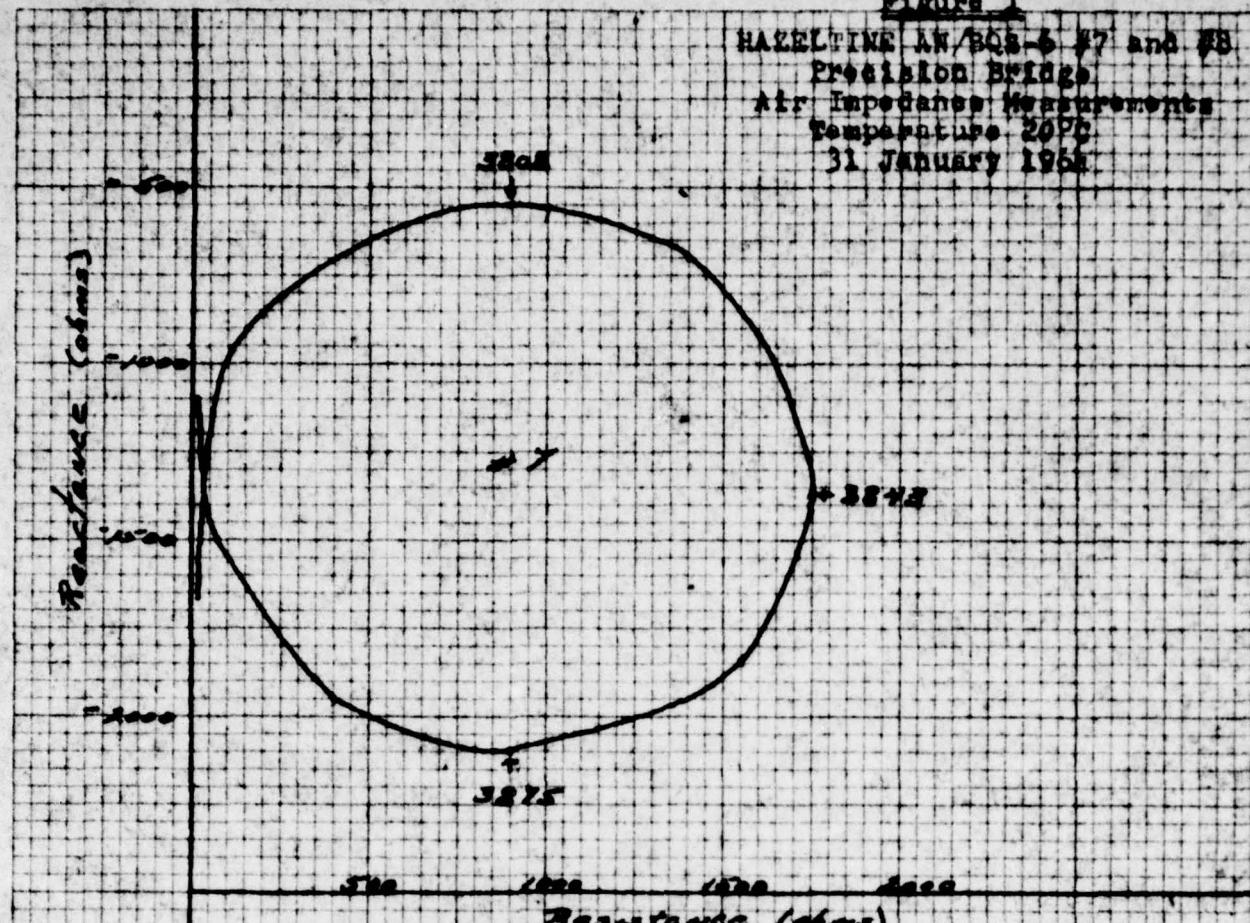
CONFIDENTIAL

Figure 1

HAZELTIME AN/BQS-6 #7 and #8
Precision Bridge
Air Impedance Measurements
Temperature 200°F
31 January 1964

EUGENE DIETZGEN CO.
SILVER SPRING, MARYLAND

NO. 240-10 DIETZGEN GRAPH PAPER
10KIO PER INCH

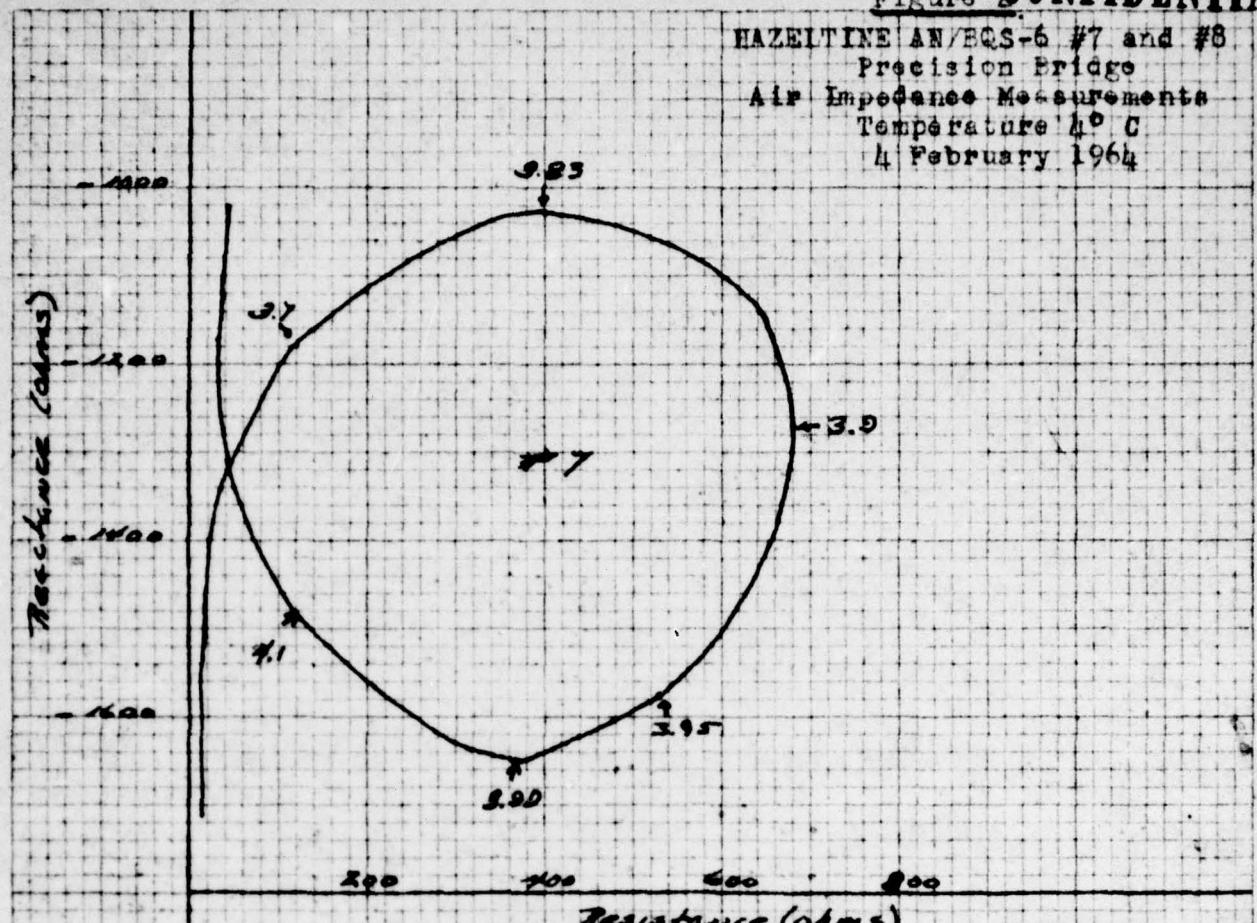


CONFIDENTIAL

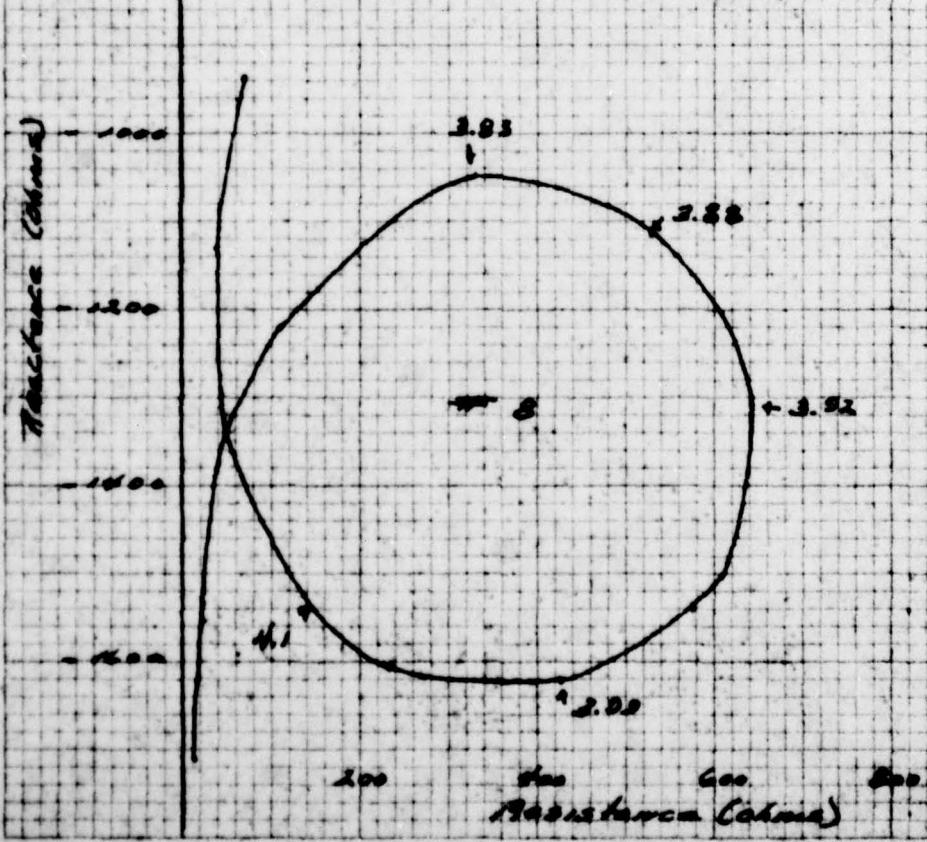
CONFIDENTIAL

Figure

HAZELTINE AN/BQS-6 #7 and #8
Precision Bridge
Air Impedance Measurements
Temperature 4° C
4 February 1964



NO. 34010 DUYGEN GRAPH PAPER
10 X 10 PER INCH

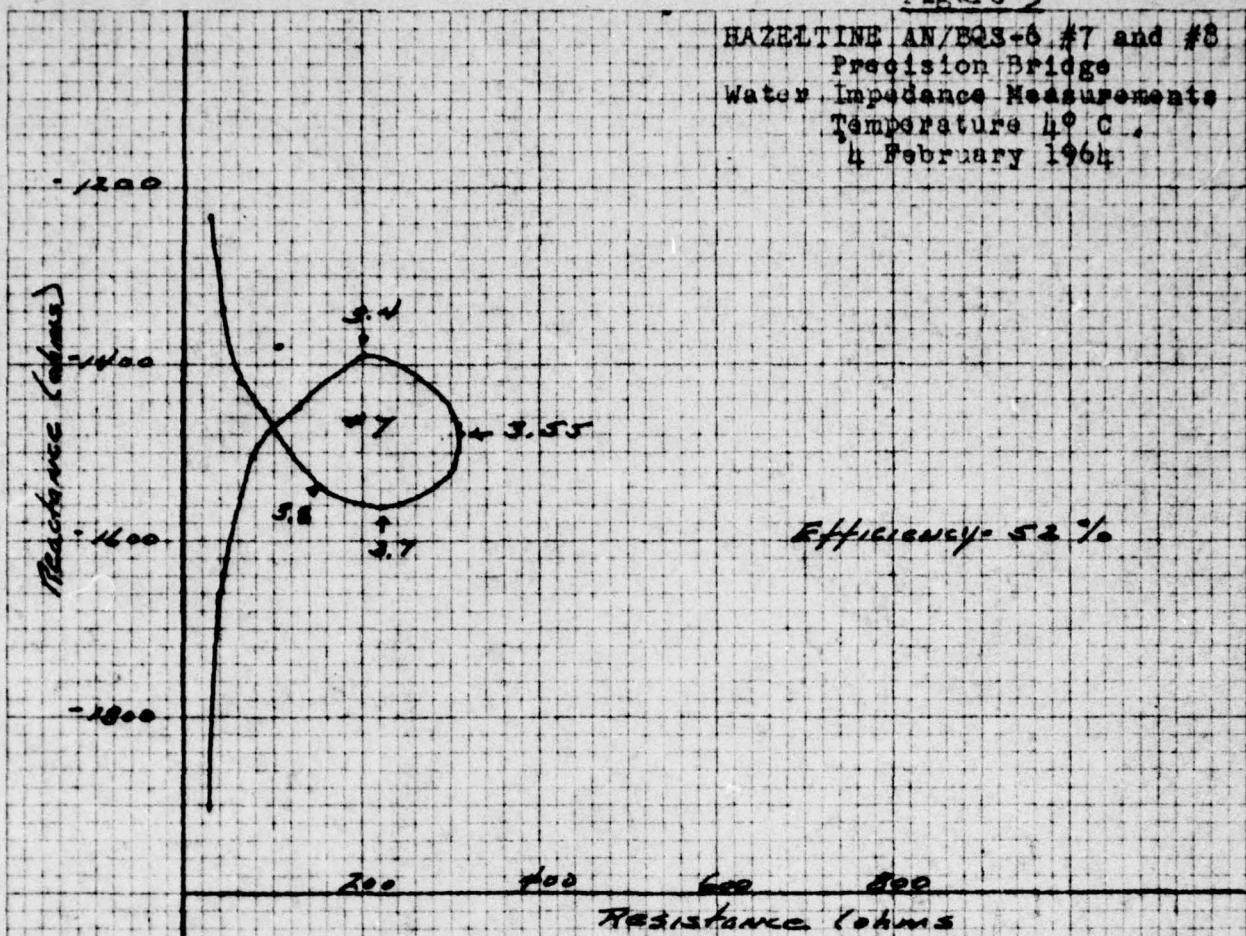


CONFIDENTIAL

CONFIDENTIAL

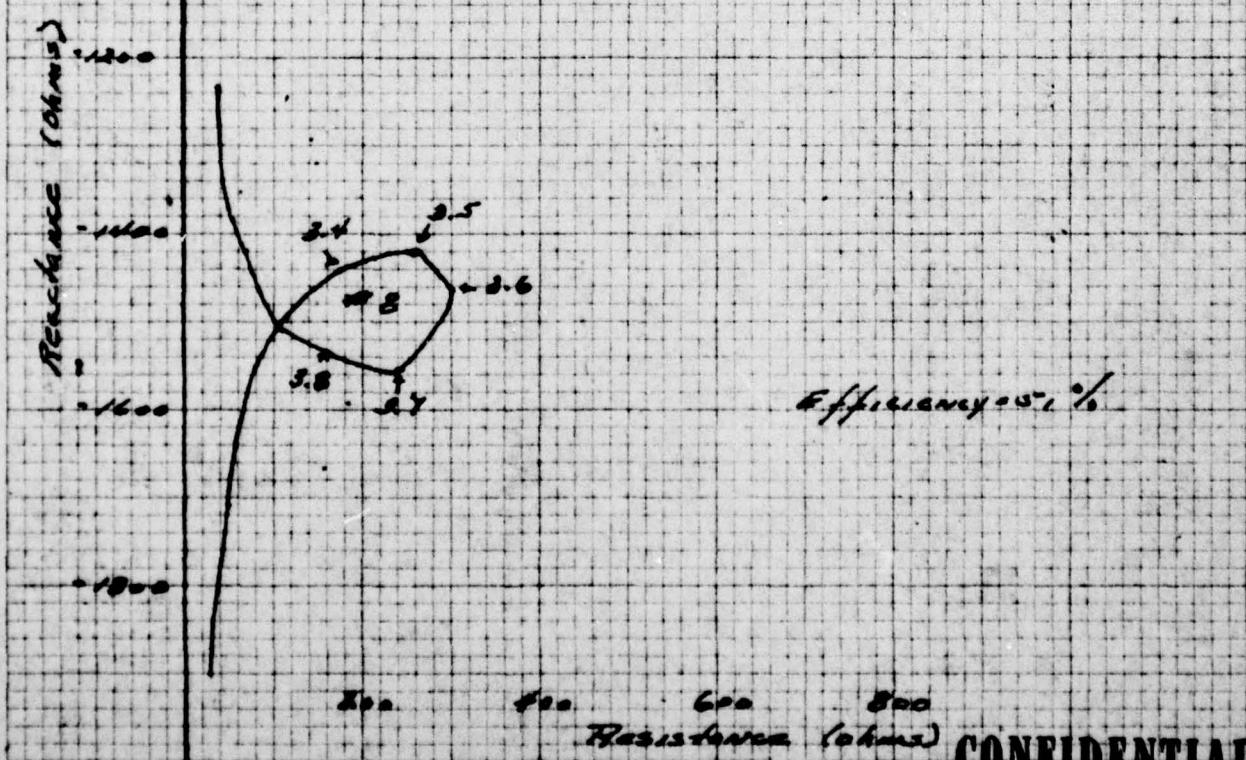
Figure 3

HAZELTINE AN/BQS-6 #7 and #8
Precision Bridge
Water Impedance Measurements
Temperature 40° C.
4 February 1964



NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADISON, WISCONSIN



CONFIDENTIAL

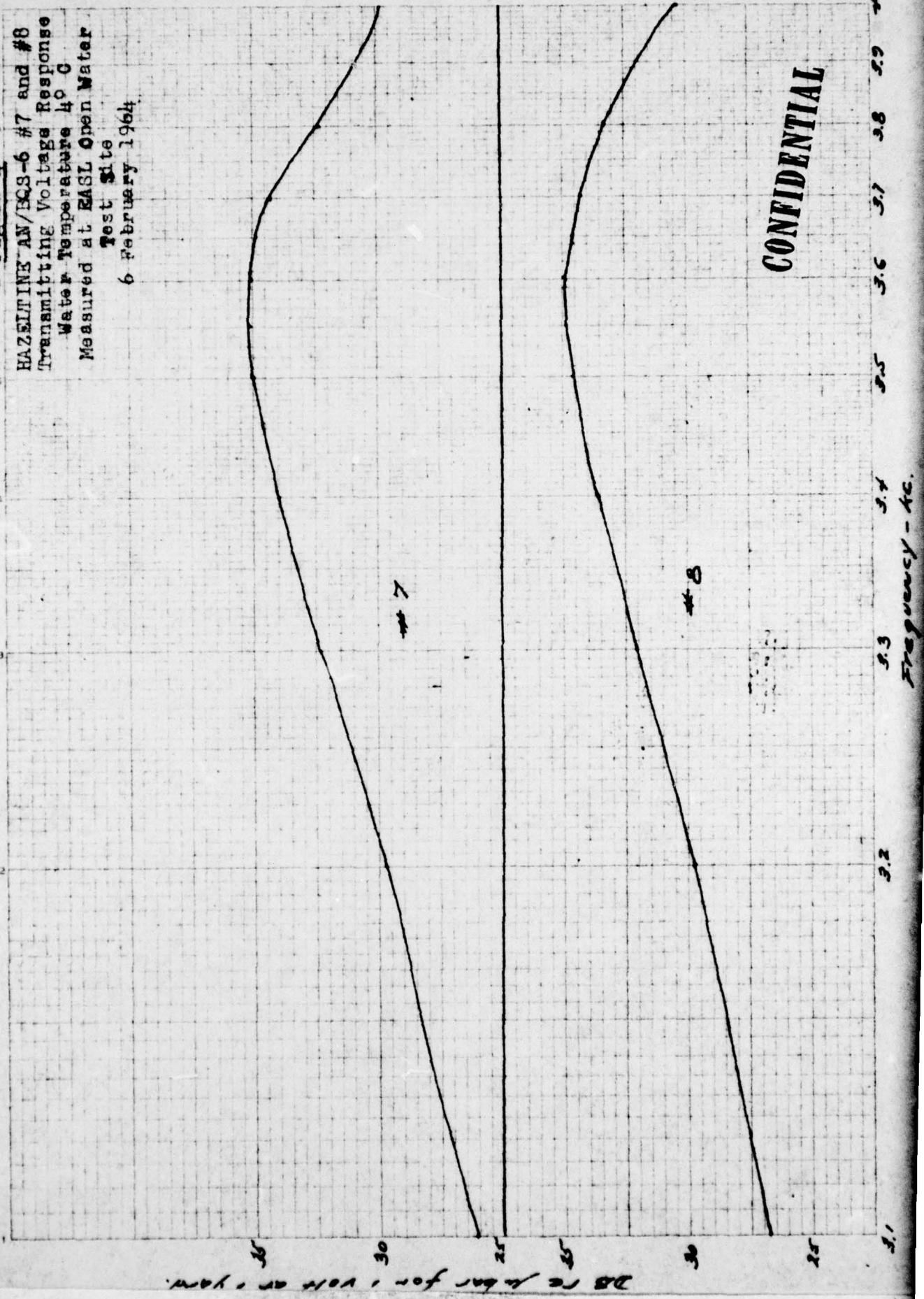
CONFIDENTIAL

EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 24C-L110 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
1 CYCLE X 10 DIVISIONS PER INCH

Figure 4

HAZELTINE AN/ECQ3-6 #7 and #8
Transmitting Voltages Response
Water Temperature 40° C
Measured at EASL Open Water
Test site
6 February 1964



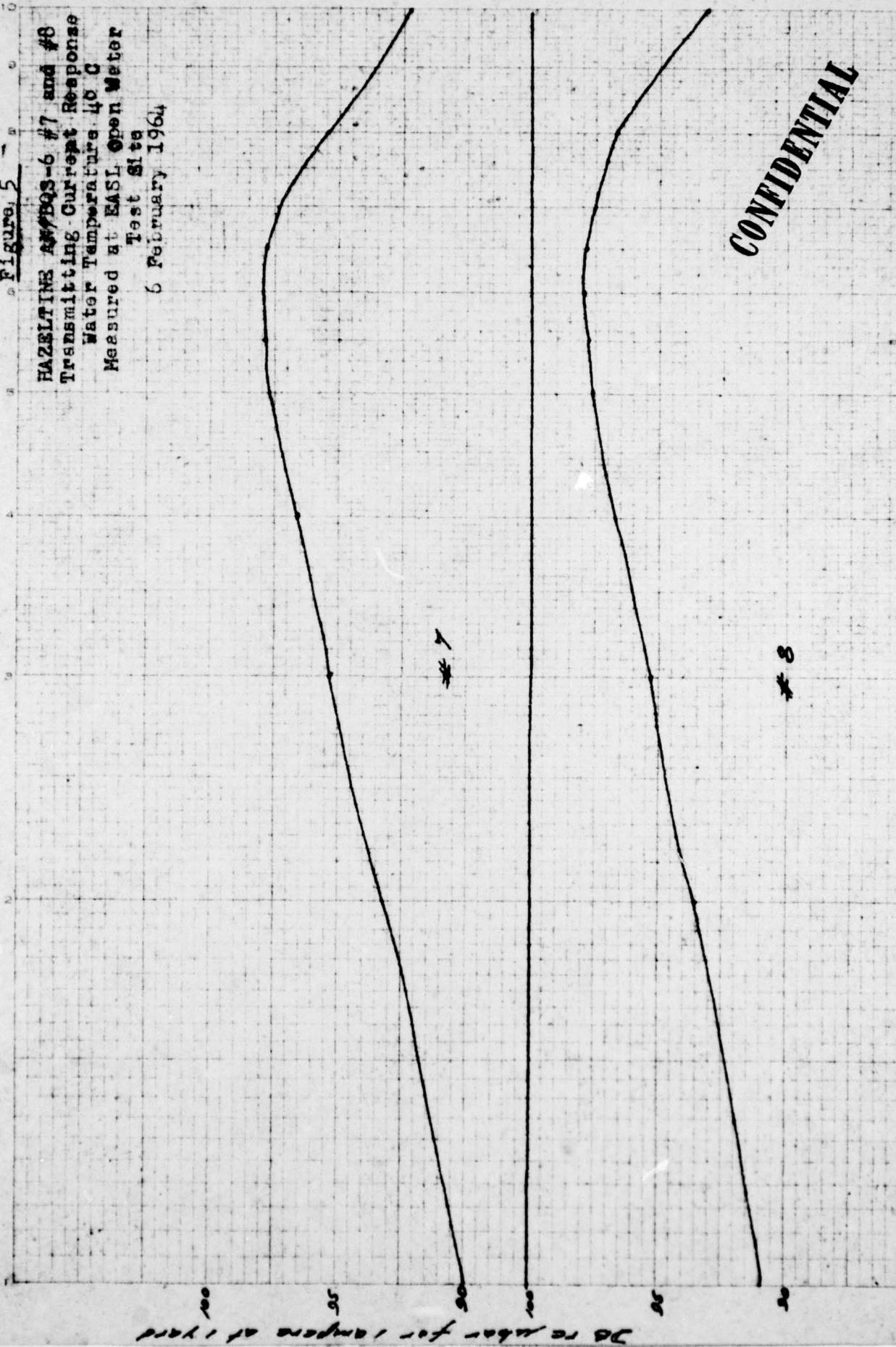
CONFIDENTIAL

CONFIDENTIAL

NO. 340-L10 DIAZGEN GRAPH PAPER
SEMILOGARITHMIC
1 CYCLE X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

Figure 5
HAZELTINE A77BQS-6 #7 and #8
Transmitting Current Response
Water Temperature 40 C
Measured at EASL Open Water
Test Site
6 February 1964



CONFIDENTIAL

12 11 10 9 8 7 6 5 4 3 2 1 0

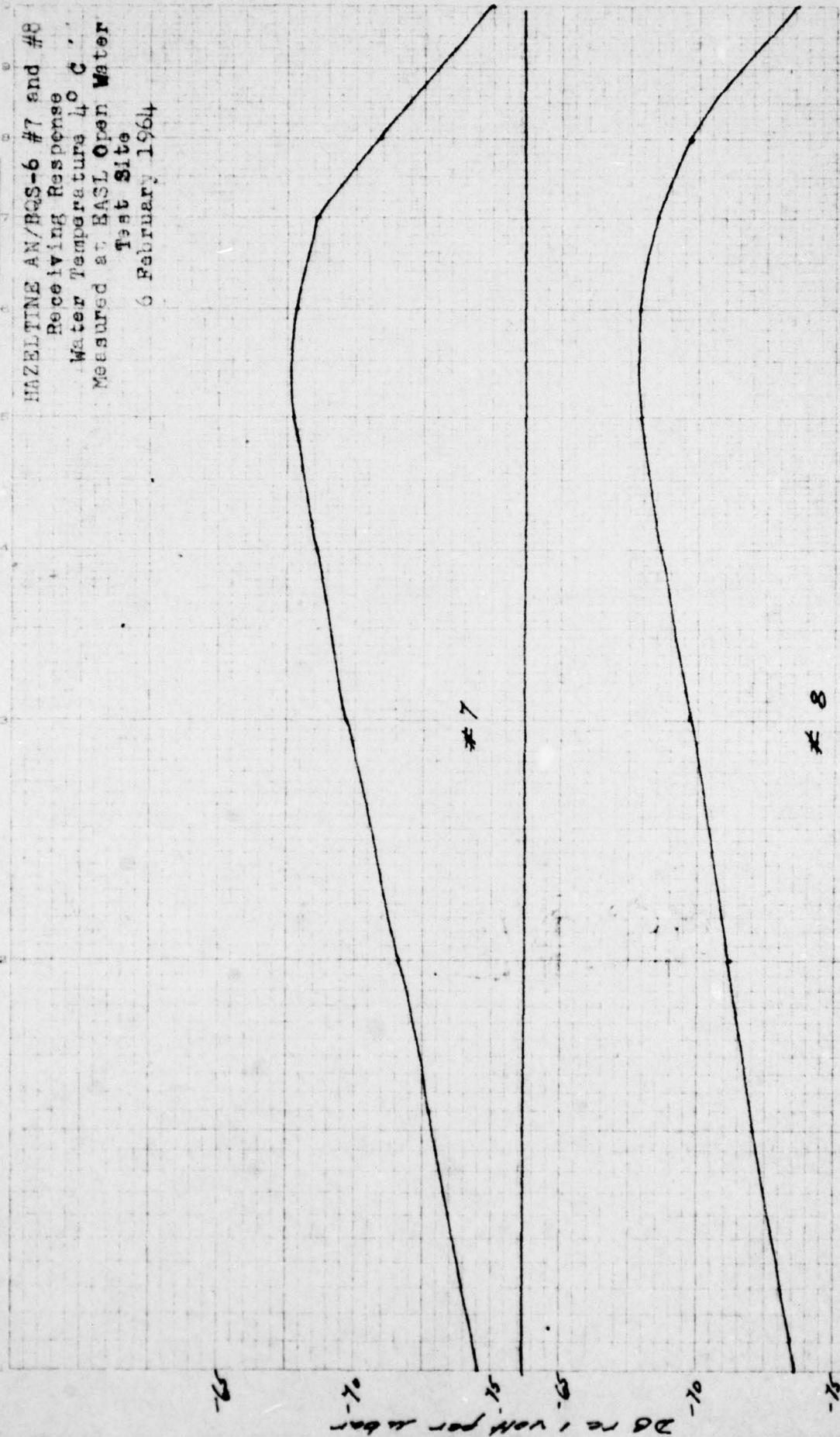
NO. 340-110 OXYGEN GRAPH
SEMILOGARITHMIC
1 CYCLE X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

CONFIDENTIAL

Figure 6

HAZELTINE AN/BQS-6 #7 and #8
Receiving Response
Water Temperature 40°C
Measured at BASL Open Water
Test Site
6 February, 1964



-10 -15 -20 -25
1000 and 1000 m DC

CONFIDENTIAL

22 23 24 25 26 27 28 29 30 31
Frequency - 40.

CONFIDENTIAL

HAZELTINE ELECTRONICS DIVISION
ELECTRO-ACOUSTIC SYSTEMS LABORATORY
AVON, MASSACHUSETTS

PROJECT DSS-1, STA 202

B-700 Polar P

VINCE

DATE 1-16-64

TELEGRAM-ELM RESPONSE

STD ECR-7

WATER TEMP: 75 DEPTH: 18' 9" SEC: 2 YDS

26

340°

30°

330°

30°

330°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

100°

270°

90°

80°

70°

60°

50°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

100°

270°

90°

80°

70°

60°

50°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

100°

270°

90°

80°

70°

60°

50°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

100°

270°

90°

80°

70°

60°

50°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

100°

270°

90°

80°

70°

60°

50°

40°

320°

50°

310°

60°

300°

70°

290°

80°

90°

270°

100°

260°

110°

250°

120°

240°

130°

230°

140°

220°

150°

210°

160°

200°

170°

180°

190°

200°

160°

210°

150°

220°

140°

230°

130°

240°

120°

250°

110°

260°

HAZELTINE ELECTRONICS DIVISION
ELECTRO-AcouSTIC SYSTEMS LABORATORY
AVON, MASSACHUSETTS

CONFIDENTIAL

PROJECT B-63-6, SER. NO. 7
3.5KC PULSE
FACE ADR. 2, DATE 1-6-64
TRANSMITTER RESPONSE STD. TP-210
WATER TEMP. 4°C DEPTH 15' 9" SEPI. 27 DS
20° 340°
30° 330°
40° 320°
50° 310°
60° 300°
70° 290°
80° 280°
90° 270°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
150° 210°
160° 200°
170° 190°
180° 190°
190° 180°
200° 190°
170° 160°
180° 170°
190° 180°
200° 190°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
50° 40°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
40° 30°
50° 40°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
30° 20°
40° 30°
50° 40°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
20° 10°
30° 20°
40° 30°
50° 40°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°
10° 0°
20° 10°
30° 20°
40° 30°
50° 40°
60° 50°
70° 60°
80° 70°
90° 80°
100° 90°
110° 100°
120° 110°
130° 120°
140° 130°
150° 140°
160° 150°
170° 160°
180° 170°
190° 180°
200° 190°

Figure 8
Beam Pattern
#7
Horizontal

Polar Chart No. 127D
SCIENTIFIC ATLANTA, INC.
ATLANTA, GEORGIA

CONFIDENTIAL

CONFIDENTIAL

HAZELTINE ELECTRONICS DIVISION
ELECTRO-ACOUSTIC SYSTEMS LABORATORY
AVON, MASSACHUSETTS

PROJECT 13Q5-6 #8

3.5Kc Vertical

DATE 2/6/6

Trans. Response

STD:

PORTER TEMP 4°C DEPTH 18' SEP 2.m

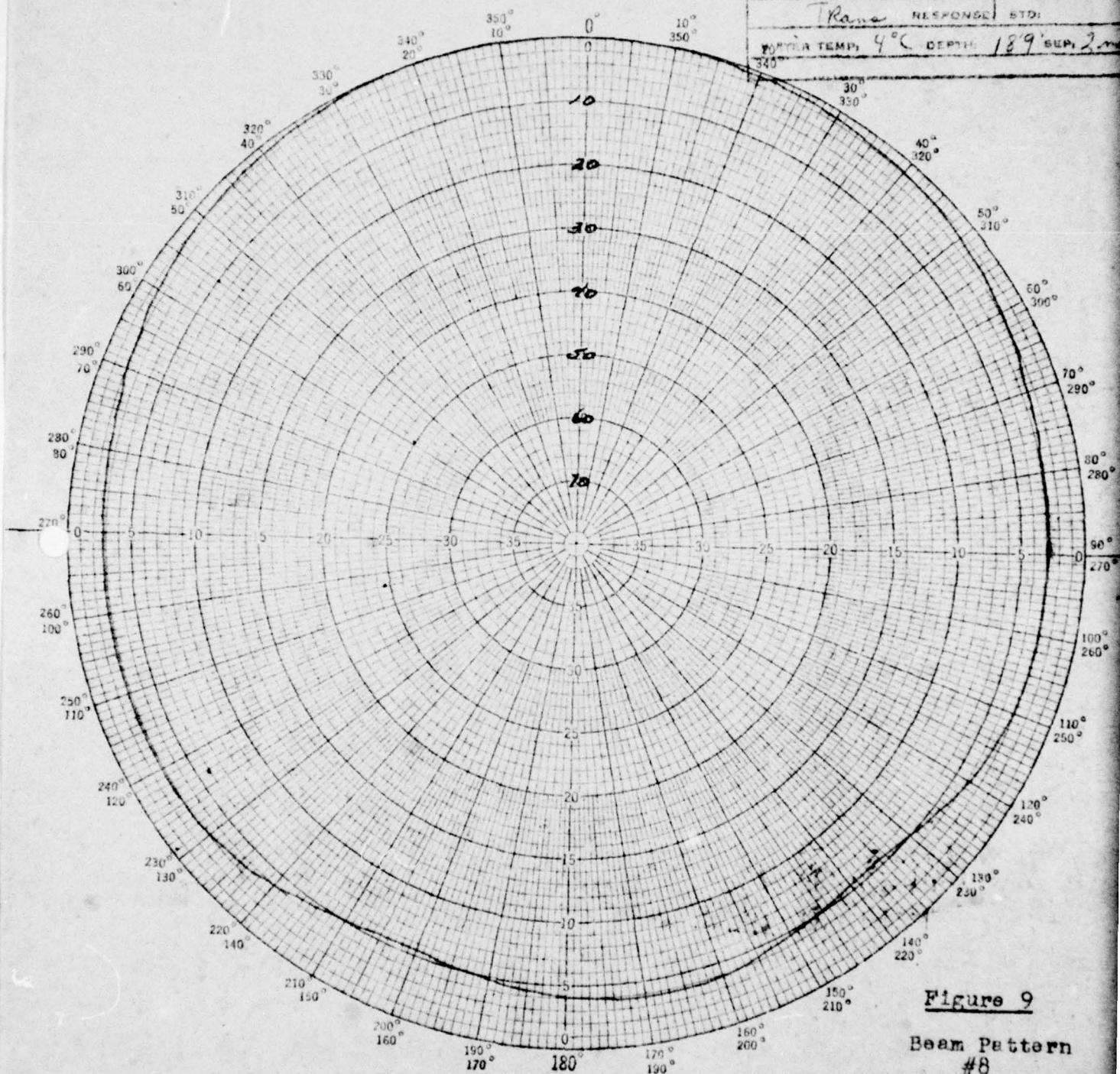


Figure 9

Beam Pattern
#8
Vertical

Polar Chart No. 127D
SCIENTIFIC ATLANTA, INC.
ATLANTA, GEORGIA

CONFIDENTIAL

CONFIDENTIAL

HAZELTINE ELECTRONICS DIVISION
ELECTRO-AcouSTIC SYSTEMS LABORATORY
AVON, MASSA CHU 1112
PROJECT: 1395-C SER. NO. 8
3.5 KC PULSED
HORIZONTAL
TRANSMITTER RESPONSE MED-BGM-1
WATER TEMP: 4°C DEPTH: 16' g/SER: 2V DS

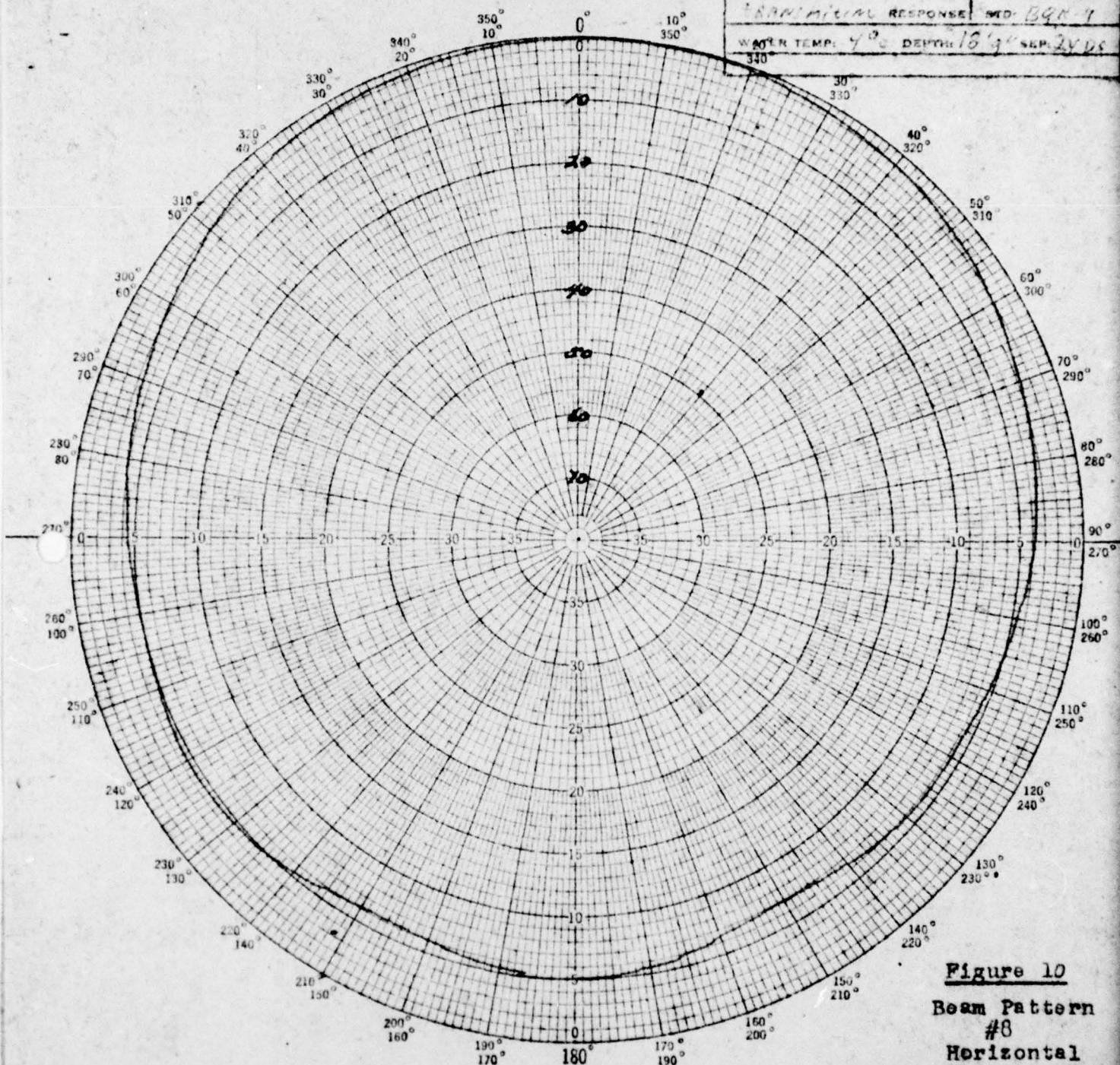


Figure 10
Beam Pattern
#8
Horizontal

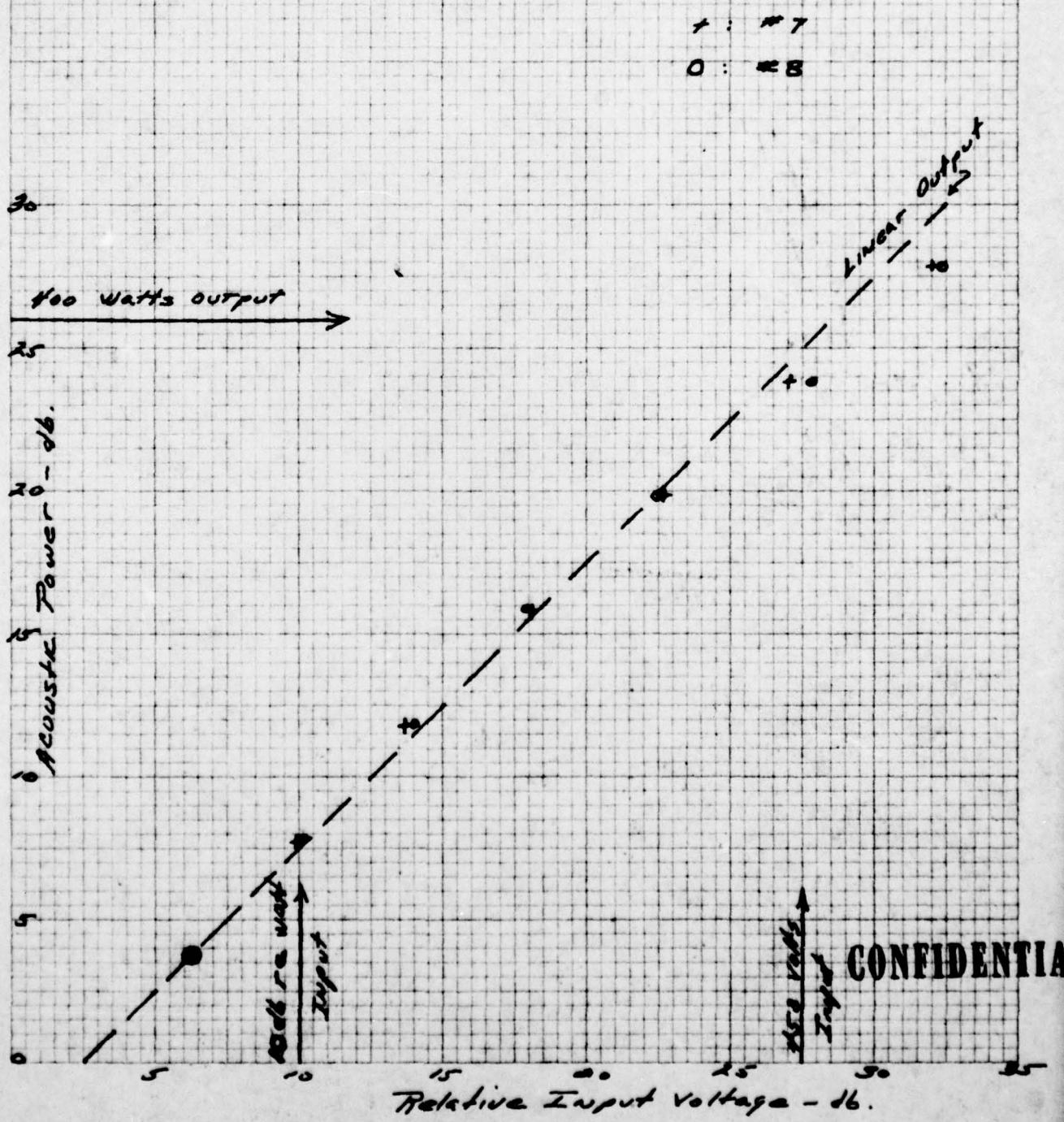
CONFIDENTIAL

Figure 11

HAZELTINE AN/BQS-6 #7 and #8
Power Linearity Measurement
At 3.5 Kc
Water Temperature 4° C
Measured at EASL Open Water
Test Site
12 February 1964

EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 540-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH



TEST DATA SHEET I

HAZELTINE AN/BQS-6 ELEMENTS #7 and #8

CONFIDENTIALHYDROSTATIC PRESSURE TEST

DC Resistance	Black to Shield	0 psi water		1000 psi water		0 psi Air	
		#7	#8	#7	#8	#7	#8
White	"	Inf	Inf	Inf	Inf	Inf	Inf
Black	White	"	"	"	"	"	"
Shield	Casing	"	"	"	"	"	"
Black	"	"	"	"	"	"	"
White	"	"	"	"	"	"	"

20 Feet of cable in pressure tank. 500 VDC Megger used for measuring.

Cycles 1000 psi

Cycle 1
 Cycle 2,3, and 4
 Cycle 5

Time at peak pressure

30 minutes
 5 to 10 seconds
 30 minutes

ELECTRICAL TESTS

#7	#8
.0295 mf	.0297 mf

Tangent of dielectric loss angle at 1Kc and 20°C
 Polarity Test
 Maximum Voltage (for 400 watt output)

.004
 White Lead pos
 600 Volts

ACOUSTICAL TESTS IN WATER AT 40°C

#7	#8
3550 cps	3575 cps

Resonant Frequency (Voltage Response)
 Mechanical Q (Voltage Response)
 Efficiency (Voltage Response and DI=1)
 Efficiency (Current Response and DI=1)
 Efficiency (Air and Water Impedance)

-1.9 db or 64%
 -2.7 db or 51%
 -2.8 db or 52%
 6.2
 -2.1 db or 62%
 -2.6 db or 55%
 -2.9 db or 51%

CONFIDENTIAL

~~CONFIDENTIAL~~

EQUIPMENT DATA SHEET I

ITEM	MODEL NO.	RED NO.	SERIAL	CALIBRATION DATE	
1 20,000 PSI ENVIRONMENTAL PRESSURE TANK (16" SHELL)	NA	NA	NA	NA	Pressure/Temp. Tests
2 Vector Impedance Lotus Plotter Chesapeake Inst. Co.	100	LY 10,017	30	10/15/63	Impedance Measurements
3 X-Y Recorder Moseley 2 DAY	LY 10,012	1095	7/16/63		Impedance Measurements
4 2KW Generator, Electronic N2000-7A CML	LY 10,000	101	NA		Power Linearity Tests 12T Test
5 Impedance Bridge General Radio Co.	1650-A	LY 10,015	4943	10/14/63	Impedance Measurements
6 Impedance Bridge ESI Z250DA	LY 10,143	249-33	7/15/63		Impedance Measurements
7 Repeat Cycle Timer Technitron 27	LY 10,006		NA		Pressure/Temp./Power Tests
8 Unit Amplifier General Radio Co.	1206 B	LY 10,037	1195	7/1/63	Pressure/Temp./Power Tests
9 Unit Oscillator General Radio Co.	1210C	LY 10,126	3041	7/1/63	Pressure/Temp./Power Tests
10 Oscilloscope Hewlett Packard	130BR	LY 10,120	8309	8/30/63	Pressure/Temp./Power Tests

~~UNCLASSIFIED~~

~~UNCLASSIFIED~~

CONFIDENTIAL

EQUIPMENT DATA SHEET I

ITEM	EQUIPMENT	MODEL NO.	HED NO.	SERIAL	CALIBRATION DATE
11	Electronic Counter Hewlett Packard	523CR	LY 10,119	1859	7/30/63
12	Electronic Voltmeter Ballantine Laboratories	300H	LY 10,134	819	9/30/63
13	Acoustic Tank Measurement System	1996	Not Assigned #2	*See notation at bottom	Trans/Rec Responses
14	Standard Hydrophone USN/USRLL	TP210	GFE	18	2/15/63
15	Meter, Secondary, Phase Acton Laboratory	709A	LY 10,094	232	12/30/63
16	Band Pass Filter Krohn-Hite	310AB	LY 10,118	2352	1/14/63
17	Precision Admittance Bridge Hazeltine	NA	NA	NA	Admittance Measurements
18	Megger - Biddle	9679	LY 6182	1108479	NA
19	J-9 Transducer	J-9	NA	134	10/15/63
					Rec Response

*Measurement System was designed and built by Hazeltine for use by the Navy and Hazeltine's Open Water Test Site. System has the provision for daily self calibration and is always used in conjunction with standard hydrophones calibrated and provided by the U.S. Navy.

UNCLASSIFIED